KetoPatch: A Novel Method for Early Detection of Diabetic KetoAcidosis

Gupta, Nehali (School: Parkland High School)

Ketosis is a metabolic state in which some of the body's energy supply comes from ketone bodies, a product of the breakdown of stored triglycerides. Uncontrolled ketosis leads to an excessive accumulation of ketoacids, and a new stage, ketoacidosis, which most often affects Type I diabetes patients in the form of diabetic ketoacidosis (DKA). If left untreated, DKA can become fatal. Currently, there are tests that doctors can run to test for DKA, and due its quick development, there are home-tests that can be run on blood and urine in order to detect DKA. However, ketones are present in other bodily fluids, such as sweat. The KetoPatch is a disposable, noninvasive, and cheaper alternative to urine tests and blood meters. To test the function and effectivity of the KetoPatch, it was first constructed with sodium nitroprusside (SNP), sodium hydroxide(NaOH), alpha-ketobutyric acid(a-KBR), which simulated the presence of ketones in sweat and a filter gauze to separate its contact from the skin. The KetoPatch was then tested to see if it produced a color change that could be qualitatively measured. Then, the SNP, NaOH, and a-KBR were reacted at different concentrations, representative of the levels present at different stages of diabetic ketoacidosis, and the intensity absorbance of their product, the pink-magenta complex, was measured using a spectrophotometer. The control was observed to have an absorbance of 1.8278 Au, the level representative of borderline DKA had 7.1494 Au, and the level representative of DKA had 31.0258 Au. This was because the KetoPatch mimics the chemical reaction in urine test strips, which allows the presence of acetoacetic acid to be detected by SNP, and yields a pink-magenta complex visible to the eye.

Awards Won: